



Remodeling of Bilateral Control in Motor Cortex after Peripheral Nerve Crossing

Su Jiang¹, Xiaohui Zhang², Haishan Yao³, Jiayi Zhang⁴, Jianguang Xu^{1,5}, Yudong Gu¹, Wendong Xu^{1*} *correspondence

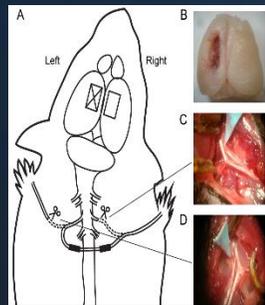
1. Department of Hand Surgery, Huashan Hospital, Shanghai Medical College, Fudan University, Shanghai, China. 2. State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing, China. 3. Institute of Neuroscience, Chinese Academy of Sciences, Shanghai, China. 4. Institutes of Brain Science, Fudan University, Shanghai, China. 5. Shanghai University of Traditional Chinese Medicine, Shanghai, China

PURPOSE

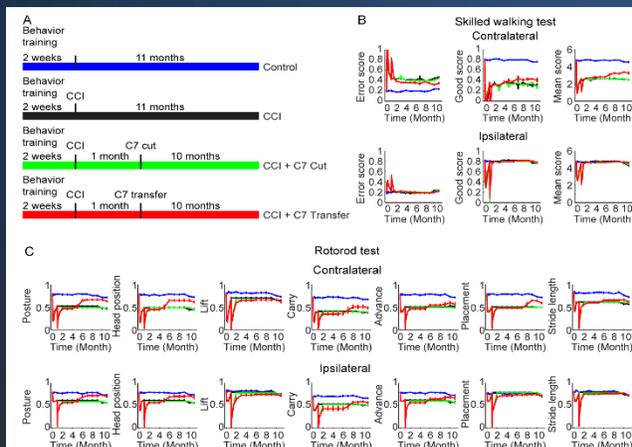
- It's challenging to treat upper extremity spastic paralysis after severe TBI
- Newly reported procedure of peripheral nerve rewiring (PNR) has produced favorable results in spasticity releasing and motor function restoration of the affected upper extremity in patients
- The aim of the current study is to examine the underlying central mechanism in motor cortical level in rodent model

METHODS

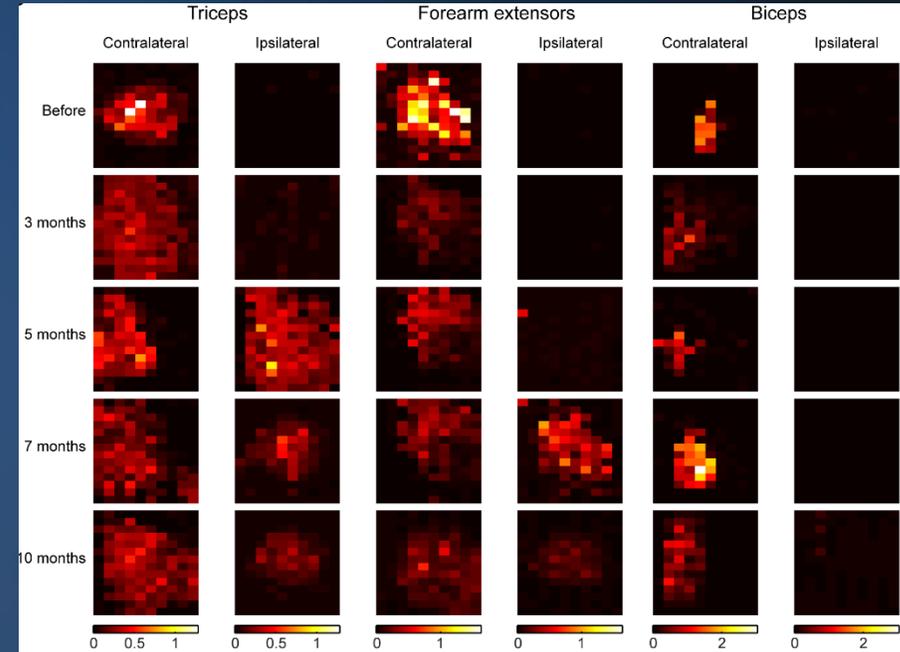
- Forty adult Thy1-ChR2-EYFP transgenic mice with thirty CCI injury of left motor cortex
- Ten received PNR(CC7-IC7-T) as experimental, ten bilateral C7 nerve roots cut(CC7-IC7-C), ten CCI mice and ten normal as control
- Behavioral evaluation: rotarod and skilled walking tests
- Electromyography evaluation: *in vivo* optogenetic-electromyography examination to map the dynamic forelimb representations
- Time interval: three, five, seven and ten months postoperatively



Left picture shows how the PNR model was established. Right: results of rotarod and skilled walking tests after model establishment.



RESULTS



Above: *in-vivo* optogenetic-electromyography mapping of the dynamic forelimb representations. From the fifth and seventh month postoperatively, a new representation area appeared on the right motor cortex that its photostimulation caused motor evoked potentials in the right triceps and forelimb extensors respectively. During the following period, the cortical representations of the right triceps and forelimb extensors persisted and began to shrink gradually, moving close to the cortical representations of left relevant muscles.

CONCLUSIONS

- PNR promoted the motor functional recovery of contralateral forelimb in severe CCI mice
- The intact hemisphere dynamically participates in controlling the movements of the bilateral upper limbs, which might be attribute to surgically enhanced ipsilateral fibers induced cortical remodeling